Entering the Queen's Chamber

From the work of **Bernard I. Pietsch** by Suzanne Thompson

Long before becoming the “father of modern archaeology,” a young Flinders Petrie set out to survey the Great Pyramid. For decades, engineers, mathematicians, and biblical scholars of every stripe had debated its size and argued its purpose. Petrie reasoned that if any theory about the Pyramid was to be based on its measurements, then what was *actually* there needed to be scientifically verified. Every inch would count. Confident in his methods and measuring rods, Petrie was prepared for the task.

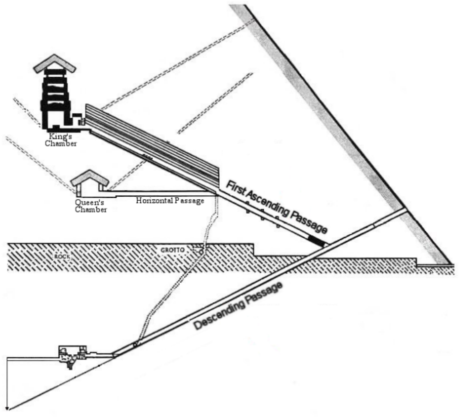

Fig. 1 Passages and Chambers in the Great Pyramid.

After painstakingly measuring the Pyramid inside and out, Petrie compared his findings with the theories offered by the Biblical prophesiers of the day. Some had gone so far as to predict the future history of the world from the dimensions of the Pyramid’s passageways. In his analysis, Petrie systematically cast out all hypotheses that were incompatible with the results of his survey. Few survived scrutiny. In 1883,[a] when his research was published, Petrie confidently announced that it had been the “ugly little facts which killed the beautiful theories” of the pyramidologists. And they had. As far as the scientific world was concerned, the symbolic and predictive interpretations promoted by the theorists had been put to rest. Accuracy had prevailed over conjecture.

While we applaud Petrie’s investigative rigor and the acuity of his findings, we make some distinctions between his approach and ours. On the whole, Petrie relied on *averaging* to determine what units of measure were used in the construction of the Pyramid. Also, he routinely dismissed as irrelevant any architectural feature which he judged incomplete or shoddy in workmanship. By contrast, we propose that there is little in the Pyramid that is without relevance. There are many design elements though imprecise or imperfect in implementation, that can be appraised as significant.

The architecture of the Pyramid is more than an exercise in the rudiments of geometry. It is a knowledge base and working model of the world given in metric and geometric representation. The units of measure employed in its coding are linked to astronomy, to biology, to geodesy, to cosmology etc. Reducing the Pyramid to simple algorithms or averaging-out its measures, as the theorists did, diminishes the power of its architectural communication. Petrie served us by eliminating the rubble of irrelevance surrounding the Pyramid, and in a sense, prepared the way for those who came after. But he did little to advance our understanding of the conceptual blueprint which organizes the stones and the spaces of the Pyramid. For that we need to appeal to a different mind set and method of reading what is there.

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[a] W.M. Flinders Petrie, The Pyramids and Temples of Gizeh, 1883, London.

For us, the genius of Pyramid design is exemplified by two distinct characteristics: *recurrence* and *integration*. Important elements of Pyramid design are always stated in more than one way, in more than one place and by more than one numerical term. Recurrence, amply demonstrated in the Queen's Chamber, is more than mechanical repetition; it is the reiteration of an idea accomplished through number. A single number describing the length of a feature in one place, may appear elsewhere as the number of degrees of an angle, or as the measure of a volume of space. The second indicator of significance, the *integration* of important features, is facilitated by canonical measures utilized in the construction of those features. Canonical measure, and the architectural elements in which they are expressed are integrally joined to one another through mathematical functions—by reciprocals, factors, divisors, roots etc.

Pyramid design is unified by a system we call the *canon of measure*. As discussed in previous chapters, each unit in the canon is a specific and recognizable "entity" which has a relationship to other units in the system. Like a biological family, each member has a unique identity and station while being interdependently connected with other members through shared attributes. In the family of the canon, the linkages between units are mathematical functions. For example, the figure we assign to the length of the common cubit is **20.6** inches. The origin of the number **20.6** is far deeper and far less prosaic than its historical association with the length of the forearm. In the canon system, the common cubit (including its various decimal expressions, .206, 2.06, 206, and 2060) can be shown to descend from at least three grand conceptual antecedents: the obliquity of the Earth's mean astronomical orbit: **1.03** (1.03 x 2 = **2.06**); the *number* of the golden ratio: **.618**: (**.618 ÷ 3 = .206**). As a divisor of **360**, the number of degrees in the circle, 20.6 also generates an influential unit of measure represented not only in the Pyramid but in the heavens as well--the canon remen, **17.47572816** inches. (**360 ÷ 20.6 = 17.47572816**) More instances of the remen, the cubit and the inter-relatedness of canon measure will surface as our analysis of the Queen's Chamber proceeds.

The use of *pi,* the squaring of the cubit, the determination of height and perimeter, all validated by Petrie, are not the conclusion of the Pyramid's story--they are the beginning.[b] The real story begins when the *static* attributes of the Great Pyramid, formed in stone and defined by measure, are coupled with *Time*—the third factor epitomizing Pyramid design. Time unifies the diverse elements of the Pyramid; Time underlies its form and function and transforms the Pyramid into a *dynamic* model. Time is the invisible factor we are bringing to the table of understanding, and one which we will find elegantly indicated in the Queen's Chamber.

A Note on Accuracy: Regarding Precision

The 10-digit numbers used throughout this presentation do not represent *measured* accuracy. Fulfilling several decimal places is a deliberate practice on our part to hold inexactitude to an accountable margin of error. Our goal is not to read strictly, but to be receptive to the concepts that guide the dimensions and geometry of the architecture. Our directive, that every detail of the Pyramid be in service to the whole, functions to keep imagination in check and interpretation responsible to the integrity of the design.

If the Pyramid has a mystique, it lies in its ability to lure the viewer deeper and deeper into a web of interconnections. Its lines, angles and spaces if enigmatic, are not impenetrable, but keys are necessary. The keys are measure—the inch, the cubit, the second of time, the second of arc etc., each a transformer that converts an experience of Nature into a definition of the natural order, into a recognizable idea. Once identified, measure can be used to decode the concepts as they were recorded in stone. In this chapter we will capture the ideas that eluded Petrie when he investigated the Queen's Chamber. By refining his measurements slightly,[c] we will restore the Chamber to its ideal form and in the process recover the instruments which drive its design. We'll begin inside the Chamber itself.

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[b] Of the many Pyramid hypotheses Petrie evaluated, there were three he deemed plausible--each with caveats: 1) That cubits were utilized throughout the structure. Petrie found that although this was often the case, the exact length of the cubit itself had to be adjusted from one feature to the next to accommodate the math. 2) That the areas of the inner chambers were divisible by round numbers of square cubits--an applicable suggestion, but not in all cases. 3) That the height of the Pyramid was meant to be proportional to the perimeter of its base, just as the radius of a circle is to its circumference. If the intended height of the Pyramid were known, this application could have governed the perimeter length of the base and by implication proved that the builders used their knowledge of *pi* in their work.

[c] See **chart** at end of chapter for our measures compared with Petrie's measures of the Niche, published in Pyramids and Temples of Gizeh, 1883. The modifications we make are minimal, often by less than tenths of an inch.

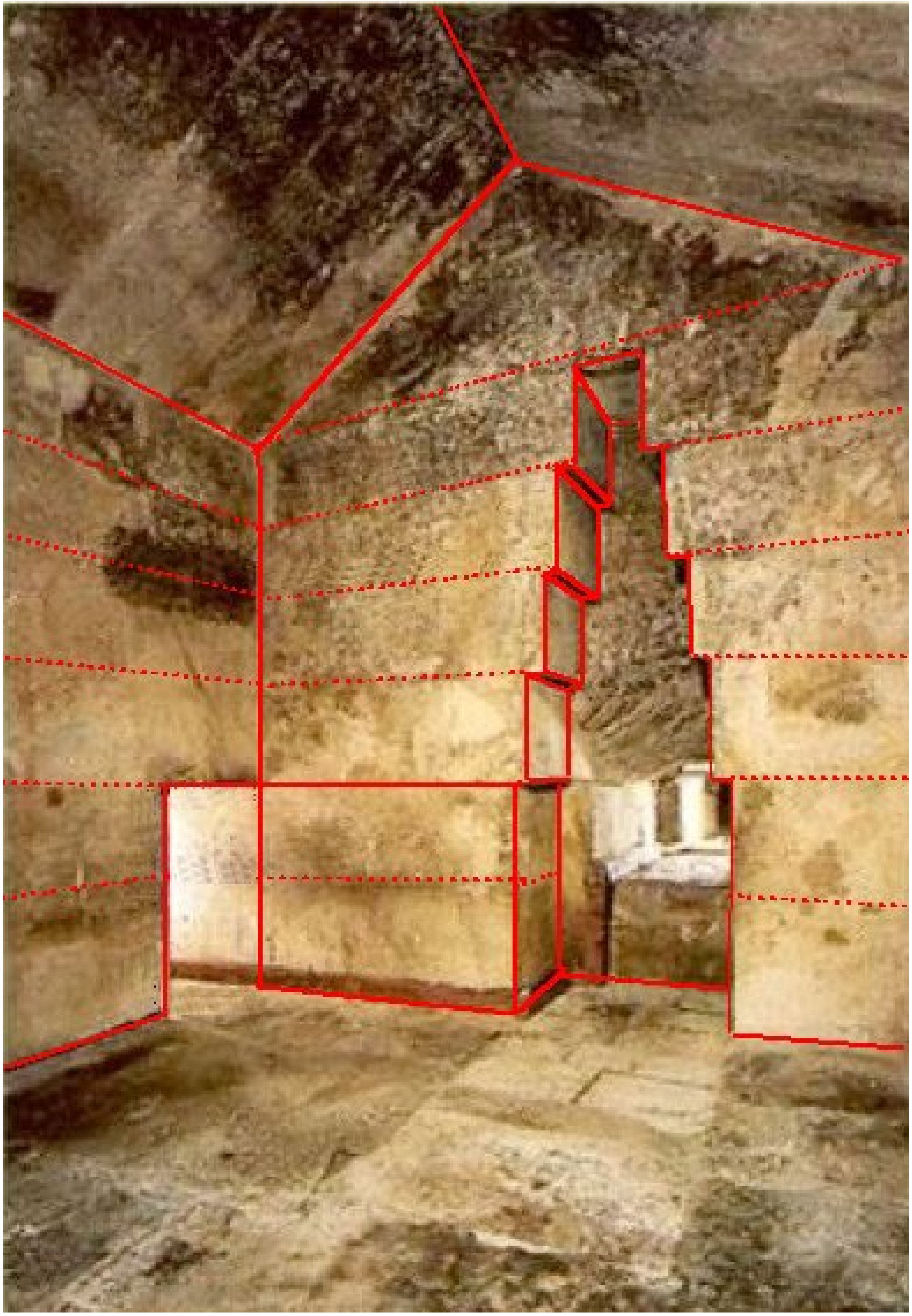

Fig. 2 Various Features of Queen's Chamber and Niche outlined.

Inside the Chamber

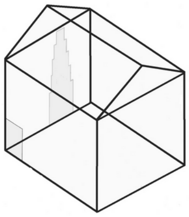
Fig. 3 Rectangular room + ceiling.

One enters the Queen's Chamber through a doorway on the northeast corner of the room. The room is rectangular and presided over by a pitched ceiling higher than the length of the room. (Fig. 3) To the left of the entrance on the east wall is the five-tiered recessed space called the Niche. The floor of the Chamber is level with the floor of the passage leading to the Doorway and like it, rough. The irregular surface of the floor in the Queen's Chamber led Petrie to suspect that it was *unfinished* and that the visible portion was actually an underlayment meant to receive finished stones. Had it been completed, he speculated, a polished floor would have been installed *between* the walls, as had been done in the King's Chamber.[d] Petrie noted the presence of a narrow "footing of fine stone" at the bottom of the walls. The top of the footing would have indicated the intended level of the floor once dressed stone had been set in place. From this ledge Petrie takes his measure of the height of the Chamber as do we.

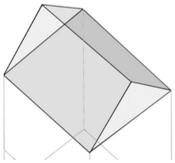
Fig. 4 Prism-shape ceiling.

A prism-shaped ceiling with triangular gables at both ends sits above the rectangular space of the Chamber walls. (Fig. 4) The top of the ceiling forms a ridge in the center of the room. Petrie calculated that this ridge was "exactly in the mid-place of the Pyramid, equidistant from its north and south sides," a point that adds additional relevance to the position of the Chamber itself.

By and large, we would characterize the architectural language of the Queen's Chamber as "cerebral." On one hand, the physical state of the lower walls and floor appeared rough and unfinished, a condition that says to me, "Approximate measures intended here." In contrast, the flavor of the dimensions and geometry of the *empty* spaces in the Chamber are decidedly abstract and intimating of precision. The Chamber space and especially the Niche exercise a certain formalism of mathematics and logic suggesting that the acuity of the geometry of the empty *spaces* is meant to be differentiated from the *physical* irregularities of the Chamber's floor and walls--a distinction admitting of the variable character of the natural world, as if to say, "Number can only approximate the vagaries of Nature; abstractions though precise, are only one facet of the whole picture."

The complexities of the Chamber offer many possibilities for interpretation. However, we have been able to identify several elements from which the design of the Chamber evolves, and around which it is organized.

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[d] Details of the floor of the King's Chamber are elaborated in the previous chapter.

Fortunately, the architect left the key *in the Doorway* to the Chamber, a key which connects the details of the Chamber to the grand themes developed by the larger architecture of the whole pyramid.

The Doorway

One concept which anchors both the Queen's Chamber and the Pyramid itself, is built into the dimensions of the doorway. It is the golden number, **Φ** , a familiar refrain in Pyramid design, but one which must be deliberately brought into play. The number we use is the reciprocal of **.618** or **1.618122977.**

Passing under the entrance we notice that the top of the Doorway is the same height as the section of passage leading to it. The height of the Doorway is even with the top of the second course of wall stones inside the Chamber. (Fig. 2) The Golden Number and its reciprocal express themselves directly and indirectly in the dimensions of the Doorway as follows:

1. The Doorway itself is **41.50715601** inches wide by **67.16368285** inches high. The width of the Door divided by its height is **.618,** which is the tangent of the major diagonal angle of the Doorway:

$$\frac{41.50715601}{67.16368285} = \mathbf{.618} \text{ tan. of major diag. angle } \mathbf{31.716}06523^{\circ}$$

2. To reinforce the association, the common logarithm of the width of the door is *also* the golden number:

$$41.50715601^{-10} = \mathbf{1.618122977}$$

3. The width x the height of the Doorway produces the number of square inches in the Doorway. (We will show shortly that the *area* of the Doorway is implicated in deriving the volume of the **1st** space in the Niche.)

41.50715601" wd x **67.16368285"** ht = **2,787.773462** sq" area of Doorway.

Ode to Venus

Of the innumerable manifestations of the golden number in Nature and in the Pyramid, perhaps the most enduring is its appearance in the *timing* of the planets of the solar system. None demonstrates **Φ** more clearly than the planet Venus. The observations which follow illustrate the influence of the golden number not only in the form and structuring of Nature but also its command over relationships in *time*.

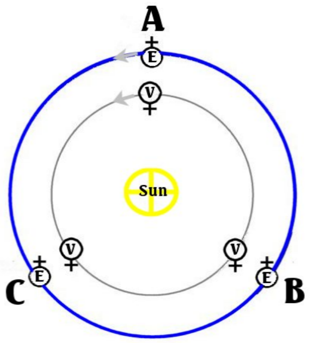

Fig. 5 Venus and the Sun appear to conjunct every 582.542 days at the Φ positions of the orbit. (360° x .618 = 222.48°)

4. If the name "Queen's" Chamber[e] reflects an early feminine association with the second planet Venus, the extent of this coincidence is deeper than names or myths would imply. It shows up in the mathematics of the relationship between Earth, Sun and Venus in the following way: Earth orbits the Sun once in **365.**25 calendar days. Venus orbits the Sun once in **225**.5586728 calendar days. If both planets were aligned at 0,° (see Fig.5 point **A**) it would take **582.524**272 days for them to meet up again at point **B** in Fig. 5. Most importantly, the events of their conjunctions would occur at points separated by the golden proportion of the orbit: **222.48** degrees. **360** degrees divided by **222.48** degrees is **1.618122977**--the golden proportion of the circle.

5. Another manifestation of the timing of this relationship is named indirectly in the diagonal angle of the Doorway to the Queen's Chamber. The diagonal angle of the Door plane is **58.28**393841.° The number **58.28**393841 x 10 is a referent to the number of days between each conjunction of Earth and Venus with the Sun: **582.524272** days. (Fig. 5)

   58.28393841 x 10 = **582.8**393841

   582.524272 days between conjunctions of ♀, ♁ and ☉

6. During the interval between conjunctions, **582.524**272 calendar days, Venus will orbit **2.582584**323 times:

$$\frac{\textbf{582.524272}\text{ calendar days between conjunctions}}{\textbf{225.5586649}\text{ calendar days Venus year}} = \textbf{2.582584}323\text{ Venus years}$$

   Looking more closely at the number **2.582584**, which is the ratio between conjunction intervals and the length of Venus' year, we recognize that that number, scaled up by 10^4 becomes **25,825.84**--the number of canon years in the precessional cycle of the equinoxes.

   2.582584 x 10^4 = **25,825.84** canon years in precession of the equinoxes.

Modern astronomy can easily predict the movements of the planets and their periodicities. But the performance of the planets was also anciently apprehended, evidenced by the harmonics of the planets designed into the architecture of the Pyramid more than 5,000 years ago. The planetary relationships and interactions we find in the architecture are most directly viewed through the lens of the ratio number we call **K, 1.01430555. K** translates Earth's *calendar year* of 365¼ days/year to 360 *canon degree days/year*. The canon system geometrically "smoothes out" planetary periodicities and exposes the authority of the Golden Number in the solar system—confirming *phi's* pervasiveness in the formulation of measure since ancient times. Beneath the labyrinth of numbers describing the various interactions of the planets, the pulse of the Golden Number organizes the attributes of the Queen's Chamber. The deeper layers of that organization unfold in the next observations when the synchronization between Earth, Venus and the Sun are expanded to include the planet Mercury. To begin:

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[e] Historically assigned because of the peaked ceiling traditionally used in tombs of females.

7. Mercury's *astronomical* year is 87.0612+ Earth days. Its astronomical period divided by **K,** becomes the *canon* period for Mercury's orbit: **85.83333** canon days.

$$\frac{87.0612}{1.01430555\ (\mathbf{K})} = \mathbf{85.83333}\ \text{canon days Mercury orbit.}$$

It was noted in #4 above, that beginning from an initial alignment at **A,** the next conjunction of Earth, Venus and Sun would occur after 582.524 days. In 582.524 *more* days, (**1,165.048544** days after the initial conjunction) another conjunction would occur. Hidden in the *reciprocal* of the number of days between this conjunction and the initial alignment is the number of canon Earth days in the period of the planet Mercury.

$$\frac{1}{\mathbf{1{,}165.048544}} = .000858333 \times 10^5 = \mathbf{85.83333}\ \text{canon days Mercury orbit.}$$

8. There's more. Mercury's rotation period (day) takes 58.0408 astronomical or calendar Earth days. Again, dividing Mercury's *astronomical* day by **K** derives Mercury's *canon* day:

$$\frac{58.0408\ \text{calendar days}}{1.01430555\ (\mathbf{K})} = \mathbf{57.2222}\ \text{canon} \odot \text{ days for Mercury to rotate once.}$$

9. With the period of one Mercury rotation, **57.2222** canon days, in mind, return to the conjunction intervals between Venus and Earth and advance to their next conjunction event. The third conjunction of Venus and Earth with the Sun (**582.524272** days x **3**) takes a total of **1,747.572816** days.[f] The reciprocal of this number (x 10^5) is the same

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[f] 1747.572816 divided by 100 is the length of the remen, **17.47572816** inches, referenced in previous chapters.

number as the number of canon Earth days in one *day* of Mercury's rotation: **57.2222** canon days.

$\frac{1}{\mathbf{1747.572816}} = .0005722222 \times 10^5 = \mathbf{57.222222}$ canon days in one day of ☿.

After **6** conjunctions of the two planets, **3,495.145631** days would have elapsed. The significance of this number will become apparent when we examine the next feature in the Queen's Chamber, the Niche and see how the numbers for time conspire with the numbers of the volumes of its empty spaces.

Deconstructing the Niche: Five Initiated from One

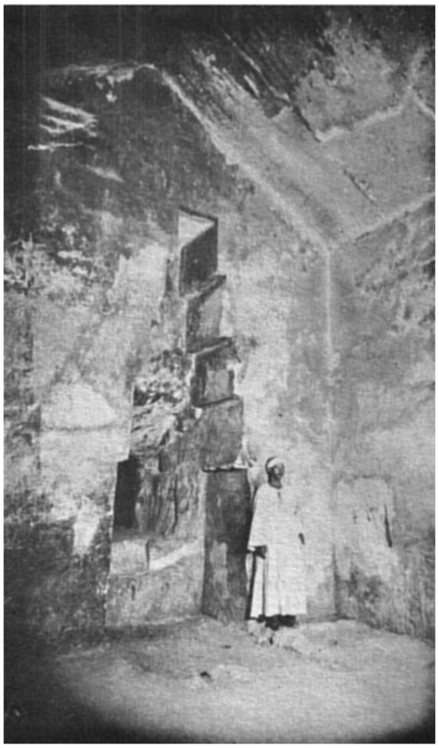

Fig. 6 Photo of Niche after excavating.

To the left of the doorway, in the east wall of the Chamber is the Niche, a series of five stacked "rectangular" spaces inset in the six levels of the wall courses surrounding the room. The empty spaces that form the Niche are not "carved out" but "built-in" *gaps* in the stone courses themselves. Except for the first tier of the Niche which is two courses high and the top of the **5th** recessed space, which does not quite reach the top of the **6th** course at the ceiling line, the tops and bottoms of the first four tiers are even with the horizontal courses encircling the room.

10. From all accounts, the five recessed spaces forming the Niche were originally uniform in depth. The back wall of the Niche, long ago breached by invasive excavations, was initially smooth and flat. (Fig. 6) The Niche's depth, based on early surveys ranged from 40.05" to 41.32". I intuited that the **depth** of the Niche was intended to reiterate the width of the Doorway at **41.50715601** inches. I and concluded that the **width** of the **1st** space of the Niche would most naturally have been meant to be **61.8** inches wide, to indicate the reciprocal of the golden number x 100: **61.8.**

11. The depth of the **1st** space times the golden number produces the height of the door, the height to the top of the **2nd** course of stones in the

wall and the height of the **1st** space in the Niche. Each of these identical dimensions is **67.16368285."**

41.50715601" x **1.618122977 = 67.16368285"**

12. Given the height, width and depth, the volume of the **1st** section of the Niche can now be calculated as **172,284.4** cubic inches.[g]

67.16368285" x **61.8"** x **41.50715601" = 172,284.4** cu" **1st** Niche space.

13. Owing to the coincidence of the relationship between the width and depth of the **1st** space, the *volume* of the first space can also be derived from the square of the number of its depth (times 100):

(**41.50715601"** depth)² x 100 = **172,284.4** cu" **1st** space.

As indicated in observation #3, the number of square inches in the Doorway (2,787.773462 sq") x the reciprocal of the golden number foreshadows the volume of the **1st** space in the Niche:

2,787.773462 sq" x **.**618 = **1,722.844**

1,722.844 x 100 = 172,284.44 cu" vol. **1st** Niche

Dimensions of the First Indicated Space

Height:	67.16368286"
Width:	61.8"
Depth:	41.50715601"
Volume:	172,284.4 cu" or 99.70162037 cu'

"As I reconstructed the design of the Queen's Chamber I became increasingly confident that the golden number was implicated in the dimensions of the doorway and first space in the Niche. Not only did my figures closely match the measures taken by the early investigators but the relationships between the dimensions were intricate and redundant. I could see that the five (implied) partitions of the Niche were meant to be read as a unified statement." This impression was underscored by the fact that the Niche is not *material,* but *formed empty* space, an attribute defined by volume. Volume is one characteristic that reduces the complexity of a form into a single calculable value. Once the volume of a space is determined its significance can be ascertained. As

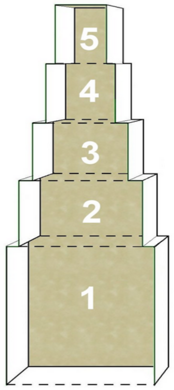

Fig. 7 Geometric spaces in Niche.

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[g] The volume of the 1st section 172,284.4 cubic inches will show up again when we consider the Horizontal Passage.

we shall see, the volumes of the spaces play a role in the reading of the Queen’s Chamber--as a sustained dialogue between the material and the indicated, between *physical* stone and the *space* enclosed by stone--one informing the other. When entering the Queen’s Chamber we physically enter this conversation. The walls, floor and ceiling define the entrance, room, and Niche. The measures are taken from that which *is*, but their relevance is found in that which is not—the empty space.

Dimensions of the Second Indicated Space

Height: 31.70756788"
Width: 52.36245955"
Depth: 41.50715601"
Volume: 68,913.76 cu" or 39.88064815 cu'

14. Given the rough physical measures of the Niche, our best estimate suggests that the volume of the first space was intended to be **2.5** times the volume of the **2nd** indicated space. By dividing the cubic inches in the **1st** space by **2.5,** I derived the number of cubic inches in the **2nd** space:

$$\frac{172{,}284.4}{\mathbf{2.5}}\text{ cu" } \mathbf{1^{st}}\text{ volume} = \mathbf{68{,}913.76}\text{ cu" volume of the } \mathbf{2^{nd}}\text{ space.}$$

The volume of the **1st** space is **2.5** times the volume of the **2nd** space. The ratio **2.5** evolves from the canon common cubit, canon *pi* and the reciprocal of the golden number, **.618**:

$$\mathbf{20.6"}\text{ cubit} \times \mathbf{3.141986363}\text{ canon } \boldsymbol{\pi} = 64.7249191$$

$$\frac{1}{64.7249191} = .01545$$

$$.01545 \times 100 = 1.545$$

$$\frac{1.545}{.618} = \mathbf{2.5}$$

Note: The reciprocal of **2.5** is **.4**. In a neat round-about way, **.4** can also be linked to the number of square inches in the area of the floor. The difference between the measured area of the floor (see #32) and that derived from .4 is less than ½ square inch.

.4 is the tangent of 21.804140949

$$\sqrt{21.804140949} = 4.669197949$$

$4.669197949 \times 10^4 = 46{,}691.97949$ sq" derived

46,692.46833 sq" measured

(.48884 sq" difference)

15. Confirmation of the width of the **2nd** space emerges from its correspondence with the common logarithm of the volume of the **1st** space, **$172,284.4^{-10}$** which is 1/10 the width of the **2nd** space above it.

$172,284.4^{-10}$ = 5.236245955
5.236245955 x 10 = **52.36245955"** width of the **2nd** space.

16. With the width of the **2nd** space in hand and knowing that all five sections are joined by the same depth (41.50715601"), the number of square inches in the area of the base of **2nd** space is easily found by multiplying width by depth:

52.36245955" w x 41.50715601" d = **2,173.416778** sq." in base of **2nd** space**.**

Note: When we get to the Lip at the foot of the Grand Gallery, we will see that the volume of the Lip would fit into the volume of the Queen's Chamber **2,173.592235** times, a difference of only .175 from the number of square inches in the base of the **2nd** space of the Niche. The "Lip" is an another architectural precursor which will be covered in the next chapter.

17. The cubic inches in the volume of the **2nd** space divided by the square inches in the area of the base of the **2nd** space, returns the height of the **2nd** space: **31.70756788** inches:

$$\frac{68{,}913.76 \text{ cu." in volume of } \mathbf{2^{nd}} \text{ space}}{2{,}173.416778 \text{ sq." area of base } \mathbf{2^{nd}} \text{ space}} = \mathbf{31.70756788"} \text{ ht. of } \mathbf{2^{nd}} \text{ space.}$$

The area of the front plane of the 2nd space can be computed by dividing the volume of the space by its depth, each of which has already been established:

$$\frac{68{,}913.76 \text{ cu" vol. } \mathbf{2^{nd}} \text{ space}}{41.50715601\text{" depth } \mathbf{2^{nd}} \text{ space}} = \mathbf{1{,}660.28624} \text{ sq" area front plane } \mathbf{2^{nd}} \text{ space}$$

Note that the area of the front plane divided by 4 then again by 10 is the depth of the **2nd** space:

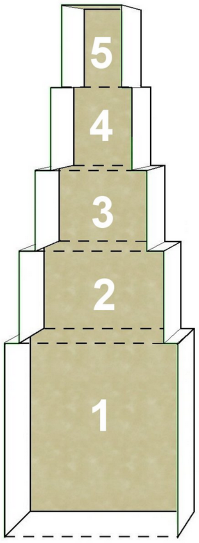
$$\frac{\mathbf{1{,}660.28624} \text{ sq" area front plane } \mathbf{2^{nd}} \text{ space}}{4} = \mathbf{415.0715601}$$

$$\frac{\mathbf{415.0715601}}{10} = \mathbf{41.50715601"} \text{ depth of Niches.}$$

To review: The dimensions of indicated space #1 and indicated space #2 in the Niche can be obtained by taking the *physical measure of* the spaces, or they can be *abstracted* from the golden number as follows:

- The golden number is **1.618122977.**
- The **depth** of each section is the same throughout--the anti-common logarithm of the golden number: **41.50715601."**
- The anti-common logarithm of the golden number squared x 100 = the number of cubic inches in the **volume** of the **1st** space. (41.50715601^2 x 100 = **172,284.4** cubic inches.)
- The reciprocal of the golden number x 100 = the **width** of the **1st** space. (.618 x 100 = **61.8"**)
- The common logarithm of the volume of the **1st** space x 10, is the width of the **2nd** space: $\mathbf{172{,}284.4^{10}}$ x 10 = **52.36245955"**
- The volume of the **1st** space divided by **2.5** is the volume of the **2nd** space. (**172,284.4** ÷ **2.5** = **68,913.76** cu.")
- Given the volume, depth and width of the **2nd** space, the height of the **2nd** space can be computed by dividing the volume by its width times its depth:

$$\begin{array}{r} V = \\ W \times D = \end{array} \frac{68{,}913.76\text{ cu.}''}{2{,}173.416778\text{ sq.}''} = \mathbf{31.70756788''}\ \text{H}$$



Note on the Ledges

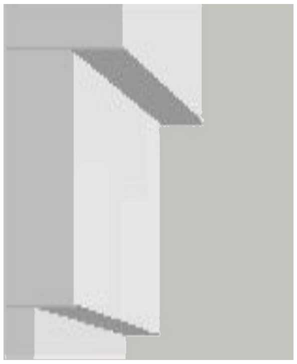


Fig. 8 Ledges or overlaps on interior of Niche.

18. The "ledges" in the Niche are actually the undersides of the stone courses projecting into the interior of the Niche; they are formed by an upper wall course over-lapping a lower course. Petrie presumed that the ledges were all meant to be the same width, and so averaged the 8 "overlaps" as he called them to ¼ cubit each. We account each ledge more precisely than Petrie, but his choice of one quarter cubit (20.6" ÷ 4 = 5.15"), is interesting. In the canon system, the number of *inches* in the common cubit, 20.6 also manifests as 20.6 *minutes*—that portion of a canon day of 1460.6 minutes which exceeds the 1440 minutes of the mean solar day. As such, the dimensions of the ledges when rounded could be seen as a nod to the *average* daily difference between solar and canon time. By our accounting the cubic volume of the **2nd** space divided by the *actual* width of the ledge atop the **1st** space approximates the duration of one canon day of 1460.6 minutes, affirming the implementation of the ratio **K** which converts 1440 solar minutes to **1460.6** canon minutes per day.

$$\frac{68{,}913.76 \text{ cu." volume } 2^{nd} \text{ space}}{4.718770226\ \text{" width } 1^{st} \text{ ledge}} = 14604.17793$$

14604.17793 ÷ 10 = **1460.41**7793 minutes

Dimensions of the Third Space in the Queen's Chamber Niche

Height: 28.284271225
Width: 41.50715601"
Depth: 41.50715601"
Volume: 48,729.38701 cu" or 28.19987674 cu'

19. The volume of the **2nd** section multiplied by the cosine of 45° is the volume of the **3rd** section.

68,913.76 cu" x **.7071067812** cosine 45° = **48,729.38701** cu" in **3rd** tier.

20. The width and depth of the **3rd** section are equal: 41.50715601", making its top and bottom planes square. The area of each plane is **1,722.844** square inches. **1,722.844** is **1/10** the number of the volume of the **1st** space.

41.50715601^2 = **1,722.844** sq" area top and base planes of **3rd** tier.

21. The height of the 3rd section follows from its volume divided by the area of its base:

$$\frac{\textbf{48,729.38701}\text{ cu" volume}}{\textbf{1,722.844}\text{ sq" base }\textbf{3}^{\textbf{rd}}} = \textbf{28.284271225"}\text{ Height }\textbf{3}^{\textbf{rd}}\text{ space.}$$

22. The height of the 3rd space, **28.284271225" ,** is the square root of the number **800**.

$$\sqrt{800} = \textbf{28.284271225"}\text{ height of the }\textbf{3}^{\textbf{rd}}\text{ space}$$

23. The cube root of the volume of the 3rd space, **48,729.38701** cu" x 10 is an indication for the number of days in the calendar year: **365.25816**

$$\sqrt[3]{48{,}729.38701}\text{ cu".} = 36.525556838$$

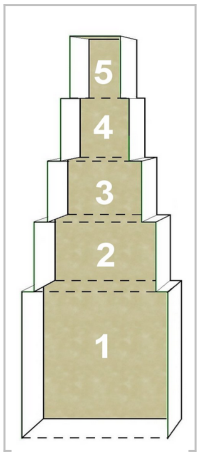
$$36.525556838 \times 10 = \textbf{365.25}556838\text{ days/year}$$

Dimensions of the Fourth Indicated Space

Height: 28.93604528”
Width: 30.4291666”
Depth: 41.50715601”
Volume: 36,547.04026 cu” or 21.14990756 cu'

24. The volume of the 3rd section x **.75** = the volume of the **4th** section.

48,729.38701 cu” x **.75** = **36,547.04026** cu” vol. of **4th** section.



Note: We would have preferred the volume of the **4th** section to have been exactly **36,515.0** cubic inches, to indicate the length of the canon year of 365.15 days. In that case, 365150 divided by 12 would have derived the number 30,429.166 which, divided by 100 would have given us **30.429166** inches for the width of the 4th section, still very close to Petrie's measure of 30.43 inches.

Using the preferential measure of **30.429166** inches given above for the width of the **4th** section, we can calculate from the volume, the height of the section as **28.93604528"**. (Petrie measured 28.94")

25. The width of the ledge at the top of the **4th** space is **5.09316523**". 5.09316523 x 10 = 50.9316523 an approximation for the mean canon rate of the precession of the equinoxes per year: **50.90**017909°

26. The reciprocal of the number of square inches in both ledges above the **4th** space, x 10^5 indicates the angle of the Earth's *astronomica*l orbit:

5.09316523" x 41.50715601" = 211.4028037 sq"

211.4028037 x 2 = 422.8056076 sq"

$$\frac{1}{422.8056076 \text{ sq"}} = .0023651531$$

$$.0023651531 \times 10^5 = 23.651531$$

As degrees, minutes, seconds 23.651531 = **23° 39' 05"**

Dimensions of the 5th and Top Space in the Niche

Height: 27.756484"
Width: 20.24283632"
Depth: 41.50715601"
Volume: 23,321.62442 cu" or 13.49631043 cu'

The top and base planes of each of the first 4 spaces in the Niche are defined by the top and bottom of the corresponding wall course in which each rectangular space is an empty gap. The 5th and highest space in the Niche is different. The top of the highest course of the wall, which is also the base of the ceiling, is *above* the top of the Niche—in other words, the top side of the 5th space is *carved out* of the stone 1.661 inches from the base of the ceiling. As it would have been easier to make the top of the Niche coincident with the top of the course, this minor detail indicates a deliberate fine-tuning in the measure and execution of the stone work. The finesse of this intention is matched by the following:

27. The volume of all five spaces in the Niche (202.4283632 cu') divided by the volume of the **5th** space is almost perfectly **15**:

$$\frac{202.4283632 \text{ cu' vol. of whole Niche}}{13.49631043 \text{ cu' vol. } \mathbf{5^{th}} \text{ space}} = \mathbf{14.99879276}$$

28. The number of cubic feet in the volume of the entire Niche divided by **10** is the same number as the width in *inches* of the **5th** space: **20.24283632** inches.

$$\frac{\mathbf{202.4283632} \text{ cu' in vol. of Niche.}}{10} = \mathbf{20.24283632} \text{ " width } \mathbf{5^{th}} \text{ space.}$$

29. The number of the ratio between the volumes of the 4th and 5th spaces is indirectly but powerfully related to the Golden Number. The short formula:

Volume of the **4th** space x **.6381262136** = Volume of the **5th** space.

It was not surprising to find the cosmological ratio **.6381262136** represented in its most perfect numerical manifestation in the Niche. The genealogy of this ratio which is deeply embedded in many planetary timing configurations will be dealt with in a separate piece, suffice it at this time to acknowledge the significance of **.6381262136** and relate a single example of the depth of its rooted-ness in the canon system of measure. Its relationship to the reciprocal of the Golden Number, **.618** spawns a connection to the canon meter:

.618 x **.6381262136** = **.394362**
.394362 x **100** = **39.4362** inches in canon meter.
39.4362 ÷ **12** = **3.2865** feet in the canon meter.

The canon centimeter is not inharmonious with the canon inch--the two denominations actually work together in the web of interrelationships of the canon of measure. It was not surprising to discover it, albeit represented by proxy in the volumes of the Niche.

Dimensions of the Whole Niche

Height: 183.848052" (Petrie: 184")
Volume: 349,796.2117 cu" or 202.4283633 cu'

30. By addition, the total volume of the **1st, 2nd, 3rd, 4th,** and **5th** sections of the Niche is **349,796.2117** cubic inches. Recall in observation #9, that the period of time between each conjunction of Earth, Venus and Sun was **582.2584**323 canon days. After 6 conjunctions **3,495.145631** days would have elapsed. 3,495.145631×100 closely approximates the number of cubic inches in the Niche:

Days in **6** conjunctions ♀ and ⊕ x 100: **349,514.5631**
349,796.2117 cu" in the Niche

31. Another timing element concealed in the Niche volume materializes by taking the seventh root of **349,796.2117** cubic inches, which is **6.194034014**. Sexagesimally that could be read as 6 hours 11 minutes 38 seconds.52—a good approximation of the last quarter day of the solar year, which accumulates as one “leap” day every fourth year in the calendar.

$$\sqrt[7]{\mathbf{349{,}796.2117}} = \mathbf{6.194034014}$$

DMS = 6 hours 11 minutes 38 seconds .52

To review:

- The volume of the 1st section x **2.5** = the volume of the 2nd section.
- The volume of the 2nd section x cosine of **45°** = the volume of the 3rd section.
- The volume of the 3rd section x **.75** = the volume of the 4th section.
- The volume of the 4th section x **.6381262136** = the volume of the 5th section.
- The volume of the 5th section x **15** = the volume of all 5 sections of the Niche combined.

The simplicity of the above litany is evidence that the Niche in the Queen's Chamber was thoughtfully constructed from principles based on number and volumes. Whether expressed as the major diagonal angle of the Doorway (58.28393477°), as the depth of the Niche (41.50715061"), or as the volume of the first section (172,284.4 cubic inches,) each of these attributes is associated with a variation on the theme of the golden number: **1.618122977**. Perhaps in the future, archaeologists will be challenged to recover the complete systematics which put the Niche in place, and of which we have just skimmed the surface.

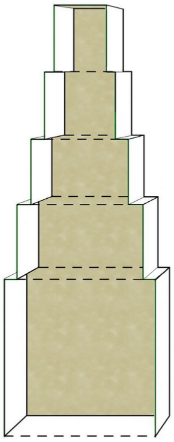


Fig. 9 Five negative spaces of Niche as volumes.

Dimensions of the Floor

Piazzi Smyth wrote in 1862 that he found the floor in the Queen's Chamber to be "in a much disorganized state...all very rough and much broken." He gives the mean length of the floor as 226.7 inches and the mean width as 205.8 inches. Petrie also described the floor as a "hopelessly irregular" surface. His average measures were similar to Smyth's at 205.85 inches wide and 226.47 inches long. The measures we choose, **206**" and **226.66246716**" are affiliated with the golden number and most importantly, support the cubic volume of the entire Chamber at **5,817.7632** cubic feet.

Length of E/W sides: 226.66246716"
Width of N/S sides: 206"
Area of Floor: 46,692.46822 sq" or 324.2532525 sq'

32. The area of the floor plane is **46,692.46822** square inches. The common logarithm of **46,692.46822** is **4.669246822**—the same number divided by 10,000.

$$\frac{46{,}692.46822^{-10}}{10^{4}} = \mathbf{4.669246822}$$

Note: **4.669246822** is very close to a concept in mathematics modernly referred to as Feigenbaum's number--the ratio of period doubling to "chaos." As **46.692,** it is also the number of inches in the width of the third row of floor stones in the King's Chamber, the group of stones we designate as representing the planet Earth.

Thus far, we have considered the Doorway, the Niche and the Floor of the Chamber. Next we will dissect the greater spaces of the room beginning with the rectangular portion comprised of the floor and the height of the four walls to the bottom of the ceiling plane. The plane of the Doorway and the front plane of the Niche, unless otherwise noted are included as part of the area of the rectangular portion. The gabled roof is considered separately.

Dimensions of the Rectangular Portion of the Chamber

Length of E/W walls: 226.66246716"
Width of N/S walls: 206"
Height of walls: 185.5097795" (Petrie: 184.7)
Volume: 8,661,909.504 cu" or 5012.679111 cu'

33. Petrie's survey determined that the ridge of the roof in the Queen's Chamber lies exactly on the east/west mid-line of the Pyramid--validating the importance of the Chamber's location, both in

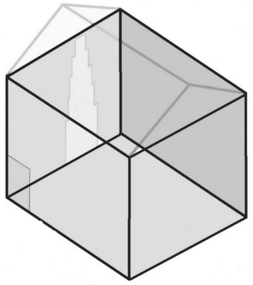


Fig. 10 Rectangular portion of Chamber.

the Pyramid and on the Earth. The intricacies of this designation are recapitulated in a singular referent--its volume. The volume of the rectangular portion of the Queen’s Chamber (not inclusive of the Niche or roof prism) is **8,661,909.504** cubic inches. The number of its volume, divided by 10,000,000 is the cosine of the latitude of the Pyramid.

8,661,909.504÷10^{07} = .8661909504

.8661909504 is cosine of **29°58'51".6875**

Latitude of the Pyramid: 29°58'51".6875

Dimensions of the Prism Ceiling Portion of the Chamber Room

Length of each roof plane: 226.6624676"
Width of each roof plane: 118.9953041"
Area of each roof plane: 26,971.76926"
Area of both roof planes: 53,943.53854 sq"
374.6079065 sq'

Apex Height: 59.5892809"
Angle at Peak: 119.8980855°
Volume of Prism: 1,391,185.287 cu"
805.0840891 cu'

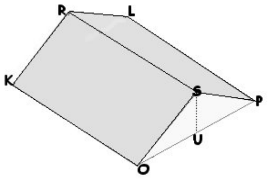


Fig. 11 Roof Planes of Prism Ceiling.

34. The area of both roof planes, **374.6079065** sq. feet, is very close to the cube root of the number of feet in the canon mile x 10,000 (**5258.16** × 10^4 = **52,581,600**) and to the number of seconds in the canon year × 100 (525816 × 100 = **52,581,600** seconds). The difference between the derived figure and the actual is only .029 square feet or 4.26 square inches.

$\sqrt[3]{52581600}$ = 374.6375164
- **374.6079065** sq'
.0296099 difference

35. The area of both roof planes, **374.6079065** square feet also approaches the area of the number of square feet in the doorway, squared:

Area of doorway: 19.3595379305 sq. ft.
19.3595379305 sq. ft.^{2} = 374.791709)

Number derived from doorway: 374.791709
Minus actual area roof planes: -374.6079065 sq. ft.
.0836441 sq. ft. difference

Height of Chamber--Floor to Apex

Height of wall, floor to bottom of ceiling plane: 185.5097796"
Ceiling plane to Apex: + 59.5892809"
Height of Chamber: 245.0990605" or
20.42492170'
(Petrie: 245.1" floor to peak)

36. The height of the Chamber, floor to peak is **20.42492170** feet. A pendulum that length would have a period of **5.00**8313494 seconds of time, e.g. The Queen's Chamber is the height of a ***5-second pendulum.***

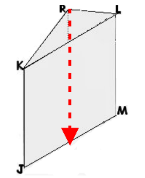


Fig. 11 Pendulum length from peak to floor.

Rectangular Portion of Chamber + Prism Ceiling

The volume of the rectangular portion of the room, (not counting the Niche) **+** the volume of the Prism is thus **5817.7632 cubic feet.**

5012.679111 cu'
805.0840891 cu'
5,817.7632 cu' in Chamber
10,053,094.81 cu" in Chamber

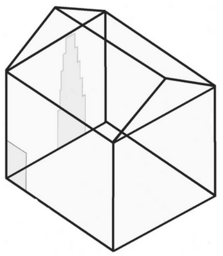


Fig. 12 Chamber volume sans Niche: 5817.7632 cu'

37. The volume of the Chamber divided by the reciprocal of 1^e (2.718281828) × 100 approximates the surface area of the room: **273,418.085** sq. inches

$$\frac{1}{\mathbf{1^e}} \text{ x } 100 = \mathbf{36.78794412}$$

$$\frac{10{,}053{,}094.81 \text{ cu" Vol. of Chamber}}{\mathbf{36.78794412}\ (1^e \text{ x } 100)} = \mathbf{273{,}271.9494}$$

273,418.085 measured
-273,271.9494 derived
146.135681 difference

Note: The difference between the measured and derived numbers for the surface area, 146 square inches, may attend the combined area of the two "air" channel openings leading toward the Queen's Chamber that were uncovered by Waynman Dixon in the 19th century. Prior to their being exposed by Dixon, the channels were "sealed off" by the

Chamber's walls. Unlike the two channels in the King's Chamber which *open into the Chamber* and *exit the exterior* of the Pyramid, neither of the Queen's channels enter the Chamber or reach the outside of the Pyramid. Our sense is that each pair of channels is an astronomical sighting device, but the distinction between those in the King's Chamber and those in the Queen's Chamber is significant. Briefly stated, in the King's Chamber the channels pertain to "visible" astronomy. The angles sighted from those channels are designed to identify the position of the sun on certain days of the year. The channels to the Queen's Chamber on the other hand, are "blocked," and identify an astronomical arrangement *not* visible during the day, an alignment that must be configured mathematically. The view from the channels in the Queen's Chamber was obscured but the channels themselves were constructed to be easily discovered, which they were. We will have more to say on their relevance and what they were sighting in a future chapter.

38. The length of the major diagonal of the Chamber (top of east Apex to mid-line of floor on west side) is 333.8404165 inches, or **27.82003471** feet. (Fig. 13) A pendulum the length of the major diagonal would have a period of **5.845075687** seconds of time.

5.845075687×100 is 584.5075687, nearly the same number as the number of square feet on the East and West walls combined: **584.014332** square feet.

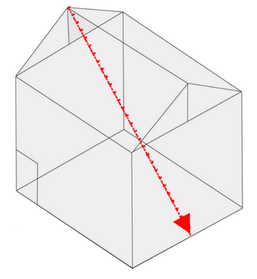


Fig. 13 Diagonal length peak to mid-wall.

39. A pendulum, **27.82003471** feet in length would beat 14,993.13348 times in one canon day of 87,636 seconds, just shy of **15,000** times. By the numbers, in one pendulum period of **5.845075687** seconds, the Earth will rotate through 14,933.13348 feet on the equator. The number of pendulum swings (forth and back) in one canon day, **14,993.13348** is the same as the number of feet the Earth rotates during one pendulum swing: **14,993.13348 feet**. A one-to-one correspondence.

Volume of the Whole Chamber

Room + Ceiling: 10,053,094.81 cu"
Niche: 349,796.2117 cu"
Total: 10,402,891.02 cu" Chamber + Niche
6,020.191563 cu' Chamber + Niche

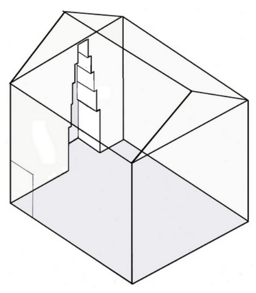


Fig. 14 Chamber volume including Niche.

40. The number of cubic inches in the volume of the entire Chamber *including* the volume of the Niche which lies exterior to the plane of the east wall (Fig. 14) will be of interest in the next observation. The number is **10,402,891.02.**

Gold, Water and the Volume of the Queen's Chamber

The volume of the Queen's Chamber including the volume of the Niche is **10,402,891.02** cubic inches. The natural log of that number is: **16.15759431**

41. The natural logarithm of the number of cubic inches in the volume of the Queen's Chamber is almost perfectly the *ratio between the grain weight of a cubic foot of gold and the grain weight of a cubic foot of water.*

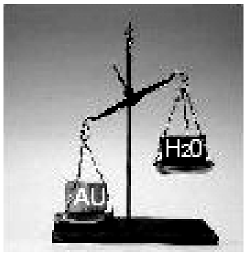


Fig. 15 Ratio of equal volumes of Gold and Water.

Because gold and water are different types of material, to illustrate this ratio we have to appeal to grain weight. Grain weight by-passes the difficulties of considering the differences between troy and avoirdupois accounting and makes it possible to compare gold and water, apples and oranges, so to speak. Grain weight allows us to make a one to one correspondence between the two commodities.

The number of grains in a cubic foot of gold (6,910,965.657 grains) divided by the number of grains in one cubic foot of water (427,722.4396 grains) is **16.15759431**

$$\frac{6{,}910{,}965.657 \text{ gr. cu. ft. gold}}{427{,}722.4396 \text{ gr. cu. ft } H_20} = \mathbf{16.15759431}$$

16.15759431 is then the ratio of the weight of gold to the weight of water using *grains*. In other words, using grains, gold weighs **16.15759431** times more than an equal volume of water *in grain weight*.

On the other hand, if the amount of gold and the amount of water were measured *in pounds* they would have a different ratio of weight to volume as gold is modernly measured as 12 ounces to the pound *troy,* and water is measured as 16 ounces to the pound *avoirdupois*. By formula, one cubic foot of water (427,722.4397 grains) weighs 61.08804266 pounds. One cubic foot of gold (6,910,965.657 grains) weighs 1200 lbs.

$$\frac{1 \text{ cu' Gold @ } 1200 \text{ lbs}}{1 \text{ cu' } H_20 \text{ @ } 61.08804266 \text{ lbs}} = \mathbf{19.64377884}$$

The ratio of pounds of gold to the number of pounds of an equal volume of water is **19.64377884**. This ratio is of interest not only because of the ritual significance of both gold and water but also because we find another expression of the relationship in the geometry of the King's Chamber.[h]

Gold, Water and the Walls of the King's Chamber

The King's Chamber displays similar information to that found in the Queen's Chamber but devised in a different way. The two Chambers are complementary to one another in this regard. In the King's Chamber the area of the *walls* (to the floor, less the doorway) is **1964.377884** square feet. Dividing 1964.377884 by 100, derives the number for the *ratio* of difference between a volume of gold weighed in troy pounds and an equal volume of water weighed in avoirdupois: **19.64377884**.

In each chamber, water and gold are joined by a single number. In the Queen's Chamber that number describes a relationship between gold and water derived from the natural logarithm of the volume of the Chamber. The number is **16.15759431**. In the King's Chamber a complementary representation is derived from the surface area of the walls in square feet divided by 100. The number is **19.64377884**. Each ratio pertains to the registration of the weight of the two commodities, water and gold, one expressed at the level of the grain, the other at the level of the pound.

The volume of the Queen's Chamber and surface area of the King's Chamber are quantifiable aspects and can be obtained objectively. The coincidence of correspondence between cubic feet and square feet on the one hand and between grain and pound on the other, is an observation acquired intuitively. In the next observations while there is no apparent logical rationale for our treatment of the volumes, the outcomes are surprising nonetheless.

42. From previously gained knowledge we know that the volume of the King's Chamber is 20 million cubic inches or 11,574.07407 cubic feet to the bottom of the walls. Divide the number of cubic feet by 30, find the square root and we have the indicator of the ratio between gold and water discussed above: **19.64377884.**

$$\frac{11{,}574.07407 \text{ cu.ft}}{30} = 385.8024691$$

$$\sqrt{385.8024691} = \mathbf{19.64185503}\ \textbf{derived}$$

(**19.64377884** perfectly)

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[h] **19.64377884** has a reciprocal of .0509067022. .0509067022 times 1000 = **50.90**67022 indicating the number of seconds of arc precession during one canon year in the cycle of the precession of the equinoxes: **50.90017909** seconds of arc per year.

Niche in a Box

As we have seen with numerous ancient sculptures, the irregular shape of a form can be contained in a rectangular “box.”

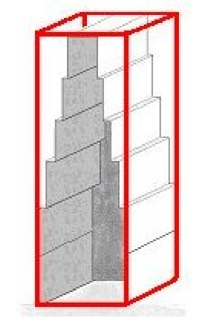

Fig. 16 The "Box" it would fit in.

43. The rectangular box that would just touch the extremities of the Niche would be 183.848052" in height, 61.8" in width and 41.50715601” in depth. In volume the box would be **471,596.4298** cubic inches. (Fig. 16)

    If the volume of the box that would just hold the extreme dimensions of the Niche were to be *coerced into a cube*, that cube would have a major diagonal of **134.8189054** inches. (Fig. 17)

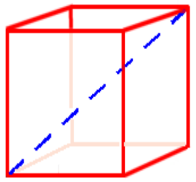

Fig. 17 The volume of the box the Niche would fit in configured as a cube.

The length of the major diagonal of the cube of the volume, **134.8189054**“ (Fig. 17) divided by 100 is nearly perfectly the number of the ratio between the actual volume of the Niche and the volume of the box that would just contain it:

$$\frac{471{,}596.4298 \text{ cu" vol. of box}}{349{,}796.2117 \text{ cu" vol. of Niche}} = \mathbf{1.348203365}$$

The number of the diagonal length of the cubed volume (Fig. 17) through the auspices of the base of natural logarithms, signifies the hours and minutes left-over in the last quarter day of the solar year:

$\mathbf{134.8189054}^{-e} = 4.903932436$

$4.903932436 \times 100 = 490.3932436$

$490.3932436^{-e} = 6.195207607$

dms = **6 hr 11 min 42.747**

44. The cubic volume of the box the Niche would fit in (Fig. 16) divided by 10,000 is quite nearly the same number as the number of inches in the width of the bottom ledge: **4.71"** (#18).

    471,597.4298 / 10,000 = 4.715974298

    4.718770226” width of bottom ledge

45. A second exercise appropriating the *volume* of the Niche entails creating a rectangular box by coercing the *volume* into the dimensions of its

height (183.848052") and depth (41.5071501") and then obtaining the width of the box by dividing the volume (349,796.2117cu") by the product of its height x its depth (7,631.009775"):

$$\frac{\underline{349{,}796.2117 \text{ cu. in. volume of Niche}}}{7{,}631.009775'' \text{ (h x d) of Niche}} = 45.83878437 \text{ in. width of box}$$

The container thus derived (Fig. 18) would be 183.848052" × 41.50715601" × 45.83878437" and 349,796.2116096 cubic inches (202.4283632 cubic feet) in volume.

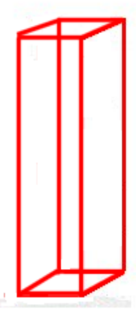

Fig. 18 Volume of Niche constrained by h x d.

Using the above dimensions, the major diagonal of the *invented* rectangular box, (Fig. 19) would be 193.9694419 inches or 16.16412016 feet. The volume of the Chamber, 5,817.7632 cubic feet, divided by the number of feet in the major diagonal of the invented box is nearly **360**:

$$\frac{\underline{5{,}817.7632 \text{ cu. ft. vol of Chamber}}}{16.16412016 \text{ ft. major diagonal}} = \begin{array}{ll} 359.\mathbf{9}183341 & \text{derived} \\ +\underline{\ .081665874} & \underline{\text{difference}} \\ \mathbf{360.}000 & \text{perfect} \end{array}$$

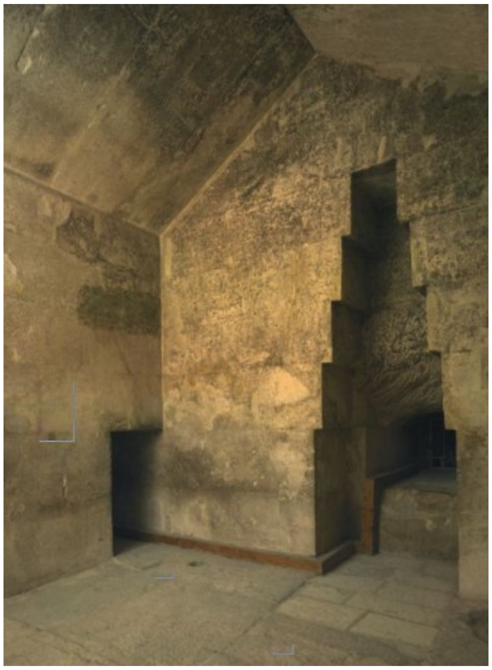

Fig. 20 Interior of Queen's Chamber showing Doorway from Horizontal Passage on left.

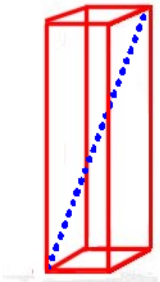

Fig. 19 Major diagonal of Fig. 18.

Entering the Horizontal Passage

Standing at the top of the First Ascending Passage, the passage bifurcates into an upper and lower route. (Fig. 23) One can either proceed up toward the Grand Gallery or continue forward on the level corridor leading to the Queen's Chamber. The lower route, called the Horizontal Passage is low and narrow; the floor is rough and uneven. One must stoop down to pass through. (Fig. 21) About thirty-five paces into the corridor, the floor abruptly drops down to a lower level which leads, after another eight paces, to the opening of the Queen's Chamber. When tourists reach this stepped-down portion of the passage they are relieved to stand upright again. The Step, over a foot and a half deep, alerts the passer, "Take notice. Pay attention here, before you go in." The Step is part of an "invisible" geometry and holds clues to the next event in our exploration.

Precursor to the Queen's Chamber

Upon encountering any major design element of the Great Pyramid, we have observed the insertion of an architectural device which *precedes* the main feature and heralds what is beyond. Prior to entering the Pyramid for instance, the measures and angles of the great Anticlinal Stones stationed over the entrance announced what was to be found in the interior. Long before reaching the Grotto beneath the Pyramid, the 5th Socket near the southeast corner of the base foreshadowed its presence. Likewise, before entering the Queen's Chamber one passes through the portal of the Doorway which is also key to the spaces within. Once inside, many details in the Queen's Chamber anticipate what will be discovered in the King's Chamber. We call each of these antecedent indicators **architectural precursors.** Predictably and in keeping with the style of the Chamber, the architectural precursor to the Queen's Chamber is located in the Horizontal Passage, and fashioned out of empty space.

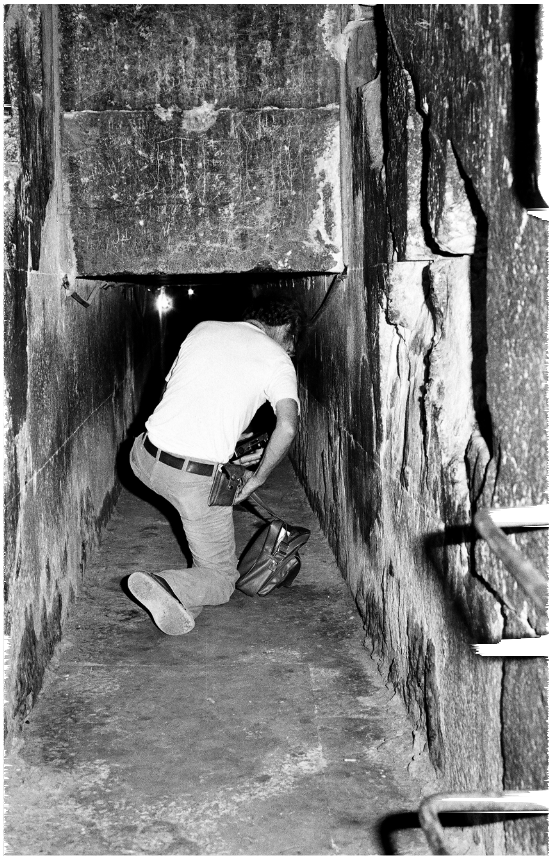

Fig. 21 Bernard entering the Horizontal Passage.

Dimensions of the Precursor

Height: 67.1636286"
Width: 41.50715601"
Length: 216.211254 "
18.0176045'

Height of step: 9.19750024"
Volume: 602,747.0992 cu"
348.8119787 cu'

Doorway: 2,787.769314 sq"

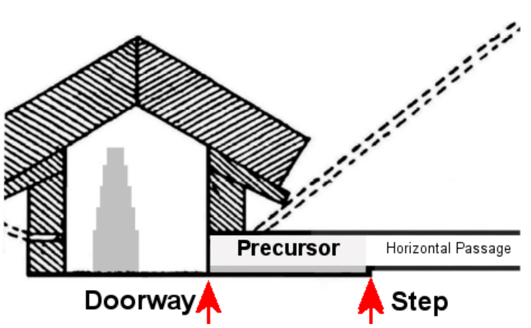

Fig. 22 Precursor space between the Step in the Horizontal Passageway and the Doorway leading to the Queen's Chamber.

This second section of the passage beginning at the Step and ending at the Chamber Doorway is the *space* we are referring to as the architectural precursor to the Queen's Chamber (Fig. 22). The space is rectangular in shape, and can be divided into two horizontal sections. The lower section, defined by the height of the Step is **19.19750024** inches in height (Fig. 29); the upper section, defined by everything above the Step, is **47.96612836** inches in height (Fig. 30). Both layers share the same width, **41.50715601** inches, and same length to the Doorway, **216.211254** inches.

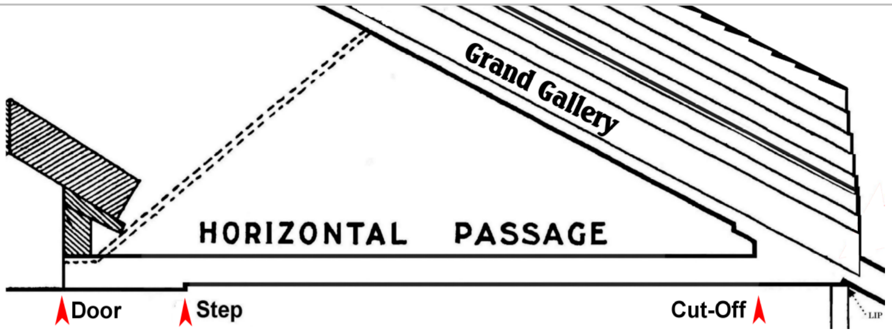

Fig. 23 Cut-off to Step: 90+ ft. Step to Door: 18+ ft. Cut-off to Door: 108+ ft.

In the corridor of the Horizontal Passage, the distance from the Cut-off to the Step, is **1,081.05627** inches (90.0880225 feet. (Fig. 23) The distance from the Step to the Queen's Chamber Doorway, the section we are calling the architectural precursor, is **216.211254** inches (18.0176045 feet) in length—exactly **1/5** the length of the Horizontal Passage.

$$\frac{\mathbf{1{,}081.05627}\text{" Horizontal Passage}}{\mathbf{216.211254}\text{" Step to Doorway}} = \mathbf{5}$$

46. It is a pertinent co-incidence that the distance from the Cut-off to the Step is **1,081.05627** *inches.* This figure, divided by 10 and read as **108.105627** *feet* is the distance from the beginning of the Passage at the Cut-off to the Doorway. (Fig. 23) [i]

47. The length from the Cut-off to the Doorway, **108.105627** feet (1,297.267524 inches) divided by **6** is the length of the Queen's architectural precursor: 216.211254 inches.

$$\frac{\mathbf{1{,}297.267524''}\ \text{Cut-off to Doorway}}{\mathbf{216.211254''}\ \text{length Queen's AP.}} = \mathbf{6}$$

48. Th×e length of the Queen's architectural precursor (× the golden number × 1000) presumes the volume of the Niche inside the Chamber:

$$\mathbf{216.211254''} \times \mathbf{1618.122977} = 349{,}856.396 \text{ cu'' derived volume}$$
$$- \underline{\mathbf{349{,}796.2217}} \text{ cu'' actual volume}$$
$$60.1765834 \text{ cu'' difference.}$$

The precision of these factors reinforces our certainty that the architectural precursor is a *metrological device*, provided as a key.

49. Looking more closely at the details of the architectural precursor to the Queen's Chamber (Fig. 24) we find that the number for the reciprocal of the height of the step (× 100) is the same number as the cotangent of the diagonal angle of the floor plane ∠**JaY** (Fig. 25).

$$\frac{1}{\mathbf{19.19750024}} = .052090115$$
$$.052090115 \times 100 = 5.2090115$$
$$5.2090115 \text{ cotan } \angle\mathbf{JaY}\ \mathbf{10.8671439^\circ}$$

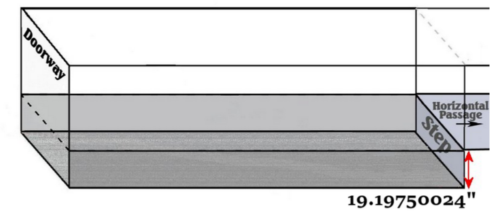

Fig. 24 Height of the Step in the Horizontal Passage: **19.19750024"**

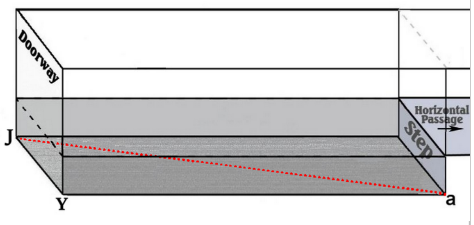

Fig. 25 Diagonal angle of floor, ∠**JaY: 10.8671439°**

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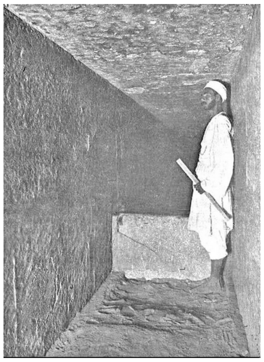
[i] The Horizontal Passage begins directly beneath the "Cut-off." The Cut-off is 223" +/- from the "Lip." The Lip is 21.2306999" from the North end of the base of the corbelled wall of the Grand Gallery. The details of these features and the points from which they are measured are often confused in reporting. They will be shown to be of significance in future chapters.

This correspondence indicates that the height of the step is another affirmation of the width of the passage as the anti-log of the golden number, **41.50715601"**.

In the first case, **19.19750024** is *inches* of height, in the second, the same number (× 100) is the number of the tangent of the angle: two different categories, same number—one is linear length the other is a geometric ascription.


Step in the Horizontal Passage.

Further correspondences

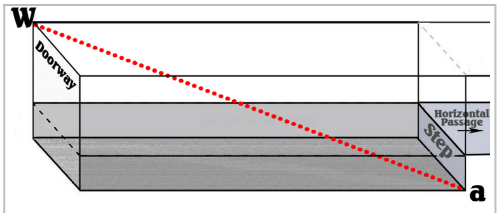


Fig. 26 Major diagonal angle of space in architectural precursor to Queen's Chamber

50. The major diagonal angle from the bottom corner of the Step (**a**) to the top of the Doorway (**W)** is **17.25**684071°. (Fig. 26)

In the Niche, the total area of all 8 ledges is **1,725**.520464 square inches.

51. The volume of the *lower* portion of the Queen's architectural precursor (Fig. 27) is equal to the volume of the **1st** and lowest section of the Niche in the Queen's Chamber:

W: **61.8"** × H: **67.16368286"** × D: **41.50715601"** = **172,284.4** cu" 1st space.

52. The volume of the upper section of the precursor, **430,463.5961** cubic inches + the volume of the lower section, **172,284.4** cubic inches = **602,747.9961** cubic inches total volume of the space between the Step and the Doorway. The ratio of the total volume divided by the volume of the lower section, (times 10^5) anticipates the number of cubic inches in all five sections of the Niche: 349,796.2116096 cubic inches.

$$\frac{\mathbf{602{,}747.9961}\text{ cu" total vol. of precursor}}{\mathbf{172{,}284.4}\text{ cu" lower section precursor}} = \mathbf{3.498563981}$$

$$3.498563981 \times 10^5 = \mathbf{349{,}856.3981}$$

349,856.3981 cu."
-349,796.2116096 cu." actual
60.1864904 cu." difference

The precursor volume is an entree to the Queen's Chamber and directs ones attention toward what is pertinent in the Chamber. It is just space, but like the Niche, it is *space defined* and a preview of what is to be found inside the Chamber.

Summing up

Petrie's investigation of the Pyramid was forensic in nature. His approach, like an autopsy, brilliantly described what remained of the Pyramid, but fell short of reanimating the essence of the building—*the working aspect which lives on in its architecture*. In the end Petrie measured everything and determined little--except that, by the sheer quantity of evidence he accrued, the Pyramid "theorists" were wrong.

From our point of view, quantification by measure without *qualification* of that measure is inadequate for the task of comprehending works of Art. As we have affirmed numerous times: the Pyramid is not an assemblage of parts, but a complex and ordered continuity, organically composed. Petrie brought his inch *to* the Pyramid; we derived ours *from* the Pyramid. The canon units of measure we applied are neither "imported" nor separate of the structure—they are an integral part of the architecture, emerging from the wholeness of concept which inspired and unified the design. Recovery of the connections between its parts to the conceptual whole of the Pyramid has been our task.

We began this essay with the notion that the Queen's Chamber is a metrological metaphor in stone. As our analysis progressed, we found that the most meaningful ideas to be extracted from the Chamber are crafted in its *negative spaces.* The walls, floor and ceiling of the room can of course be accessed directly; the shapes of the stones are tangible--their dimensions and angles can be physically measured. Empty space, however, is neither physical nor visible. Though contained by that which is sensible, empty space is a dimension unto itself – a dimension detectable as *volume*. Volume is *in* the room, but it is not the room. Volume is defined by walls, floor and ceiling, yet it is not walls, floor or ceiling. Volumes of space, organized by form and accessed through geometry, measure and calculation, can only be named by computation. This most essential communication of the Pyramid and the Queen's Chamber – *empty space* -- does *not* exist: it is *no*-thing. And yet this empty space – this *no*-thing – requires the structure of the physical Pyramid to be realized.

The identification of empty space in Pyramid design plays an important role in the discernment of another indicator of significance, a function we call architectural *recurrence*—a means by which *detail is made accountable to the whole*. Physically and conceptually the inner chambers of the Pyramid support the container of the outer structure; likewise, its outer dimensions are reflected by the inner, a reciprocation uniquely demonstrated by the volume of the Queen's Chamber and its relationship to the height of the Pyramid. Had we gone into the Chamber, measured all of its features and calculated the dimensions of the whole, we could have realized that the volume of the room, **5,817.7637** cubic *feet* is in effect corroborated and restated by the height of the Pyramid to its projected apex, **5,817.7632** *inches*. Both features are differently shaped; both are "empty." The Chamber volume is empty, the apex, which terminates *above* the last course of stone at the top of the Pyramid, is empty. In both cases an attribute of pure space is named—one is identified as the number of cubic feet in the Chamber, the other as the number of inches in the height of the Pyramid to its geometric terminus. The referent numbers are coincident, reiterative and affirmative of the concept.

The Horizontal Passage revealed to us further indications of organized empty space. There, we isolated the area from the Step to the Doorway as a "precursor" element to the architecture of the Queen's Chamber. Within this section of the passage, we identified two geometries, the whole space (floor to ceiling) and the lower portion of that space (floor to the height of the Step) and computed each portion as a *volume.* The numbers defining the attributes of the precursor recur both as volumes of the Niche spaces, and as factors in the length of the Horizontal Passage.

The Niche in the Queen's Chamber proves to be another extraordinary example of orchestrated empty space. Five rectangular forms – each an empty space "created" by the *absence* of stone, are inked to one another by mathematical invention. Characteristic of Pyramid design, the architectural message of the Niche is only partial. What is there, is incomplete. Completion of the architect's message requires the active engagement of the observer using number, geometry and the keys of the canon of measure. The reward for the participant's effort to extract the indicated concepts is an experience of reciprocation, of contact with the mind of the designer—a communication which in its receipt, is the ultimate homage to the builder. Whether it takes a moment or a millennium, when communication is achieved, the legacy of the architect is fulfilled.

In a final assessment, the Queen's Chamber is an architectural expression of "deity" revealed in space. Here in the Queen's Chamber the gods are joined by a single principle: the golden number, *phi,* ***Φ***, the "divine proportion," as it is so often and rightly called. Both everywhere and no-where, the divine proportion permeates and informs the Queen's Chamber. Invisible and yet calculable, *phi* is the inescapable principle which all obeys: the cosmic algorithm guiding shape, growth and pattern in Nature.

In other epochs, in other cultures, artists would have decorated the walls of their most holy places with images of their deities. Inside the Pyramid there are no paintings, no storied representations, no images. All is line, form and space. But to the mind that conceived the design of the Pyramid, the gods are present--discreetly displayed in every doorway, passage and empty chamber.

To visualize the gods, we are obliged to bring them to life with number, geometry and the canon of measure. It is to be hoped that one day, others will use the many indications we have recovered from the Pyramid to decode the entire topology of the system that put it in place.

❧

Queen’s Chamber Niche: Comparison of Dimensions

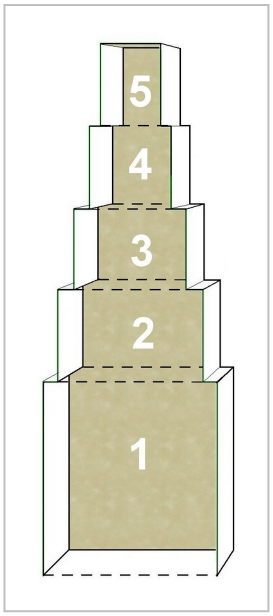
Indicated Dimensions *Petrie’s Measures*

Space Number One (Lowest)

Depth:	**41.50715601"**	**(Petrie: 41.32")**
Height:	**67.16368286"**	**(Petrie: 67.17")**
Width:	**61.8"**	**(Petrie: 61.74")**
Volume:	**172,284.4 cu"**	

Space Number Two

Depth:	**41.50715601"**	**(Petrie: 41.05")**
Height:	**31.707567888"**	**(Petrie: 31.79")**
Width:	**52.36245955"**	**(Petrie: 52.74")**
Volume:	**68,913.76 cu"**	



Space Number Three

Depth:	**41.50715601"**	**(Petrie: 41.20")**
Height:	**28.28427125**	**(Petrie: 28.23")**
Width:	**41.50715601"**	**(Petrie: 41.83")**
Volume:	**48,729.38701 cu"**	

Space Number Four

Depth:	**41.50715601"**	**(Petrie: 41.06")**
Height:	**28.93604528"**	**(Petrie: 28.94")**
Width:	**30.429166"**	**(Petrie: 30.43")**
Volume:	**36,547.03576 cu"**	

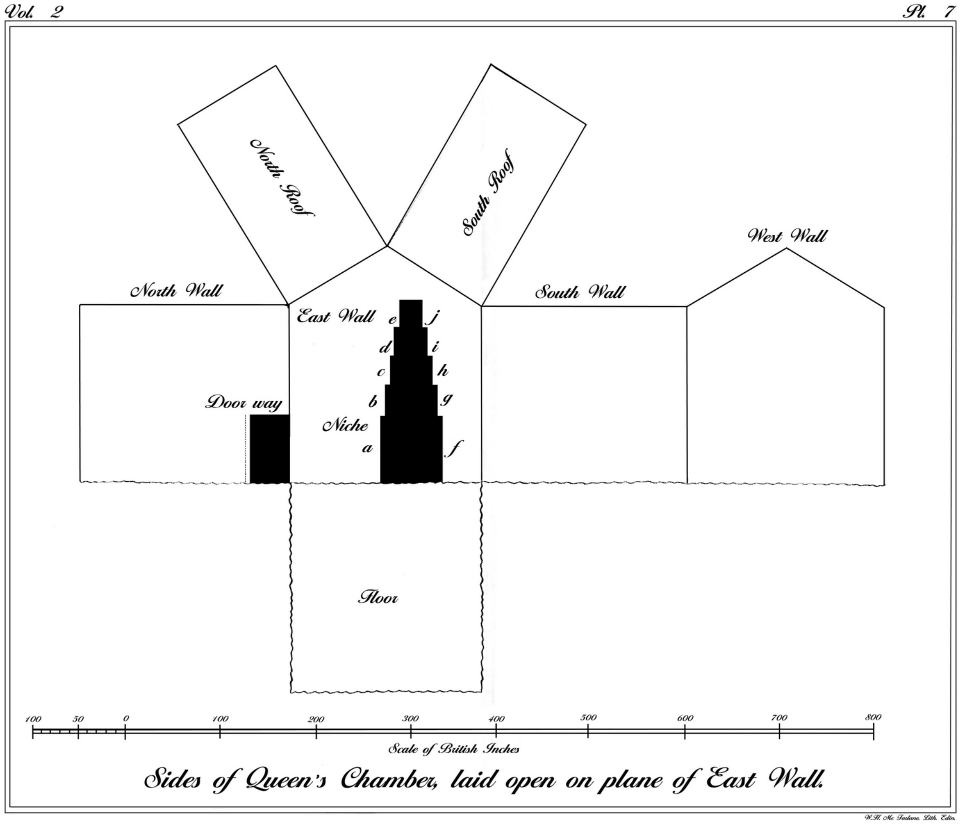
Space Number Five (Topmost)

Depth:	**41.50715601"**	**(Petrie: 40.72")**
Height:	**27.756484"**	**(Petrie: 27.70")**
Width:	**20.2428362"**	**(Petrie: 20.30")**
Volume:	**23,321.62442 cu"**	

Total Space

Depth:	**41.50715601"**
Height:	**183.8480515"** or **15.32067096'**
Volume:	**349,796.2117 cu"** or **202.4283632 cu'**

Folded Out Diagram of the Queen's Chamber



Sides of Queen's Chamber, laid open on plane of East Wall.

Rectangular Portion of Room

JK, LM, PQ, NO Walls height: **185.5097795"**
15.45914829'

KO, JN, LP, MQ Walls length: **226.6624676"**
18.88853897'

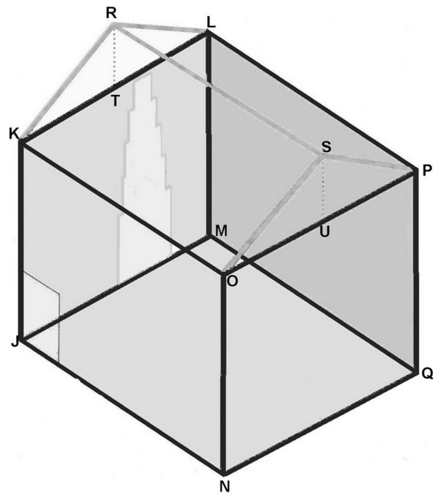
KL, JM, OP, NQ Walls width: **206"**
17.16666'

□JKLMJ, □OPQRO Areas E and W Walls:
38,215.01458 sq"
265.3820457 sq'

□JKONJ, **□LMQPL** Areas S and N Walls:
42,048.10438 sq"
292.0007249 sq'

□KLPO, **□JMQN** Areas Floor, Ceiling planes:
46,692.468333 sq"
324.2532523 sq'

Volume: **8,661,909.504 cu" 5,012.679111 cu'**



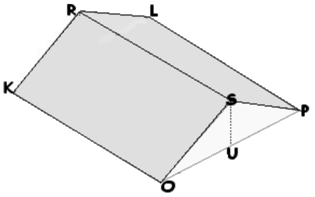
Roof Planes

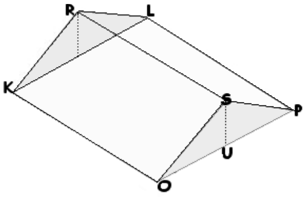
KR, OS, LR, PS : Width each Roof Plane: **118.9953041"**
9.916275342'

KO, LP, RS: Length each Roof Plane: **226.6624676"**
18.88853897'

□KRSO, □LPSP: Area each Roof Plane: **26,971.76926 sq"**
187.3039532 sq'

□KRSO+□LPSP Area both Roof Planes: **53,943.53854 sq"**
374.6079065 sq'





Gables

OP, KL Gable base: **206"**
17.16666'

RT, SU Gable altitude: **59.5892809"**
4.965773408'

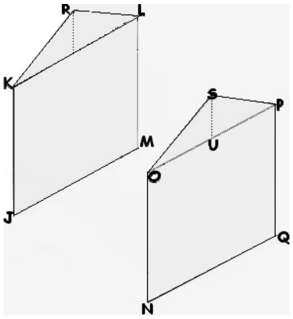
Δ KRLK, Δ OSPO Gable area: **6,137.695937 sq"**
42.62288845 sq'

Δ KRLK + Δ OSPO Area both Gables: **12,275.39187 sq"**
85.24577688 sq'

∠KRL, ∠OSP Apex angle: **119.8980855°**

∠OSU, ∠PSU ½ Apex angle: **59.94904274°**

∠SOP, ∠SPO Exterior angle: **30.05095725°**



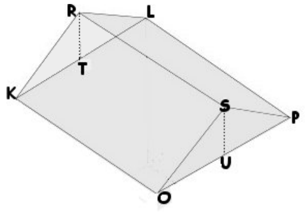
Prism

Volume: **1,391,185.287 cu"** or **805.0840891 cu'**

Walls

□JKLM, □OPQR Area E, W Wall: **38,215.01606 sq"**
265.3820559 sq'

□E Wall **+Δ**E Gable Area, □W Wall **+Δ**W Gable area:
44,352.71052 sq"
308.0049341 sq'

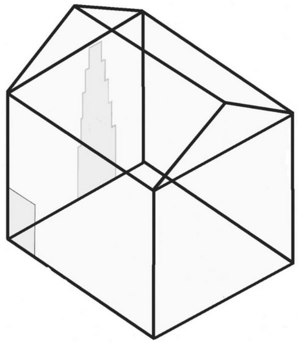


Floor to Apex

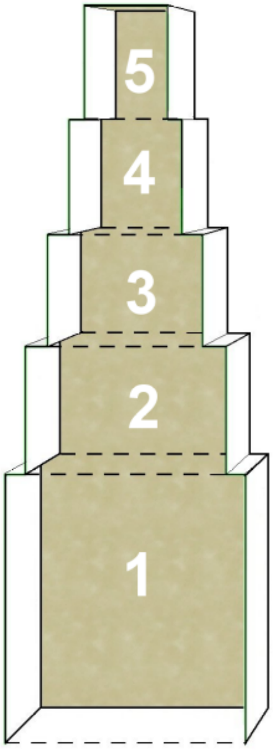
Floor to Apex Height: **245.0990604"**
20.4249217'

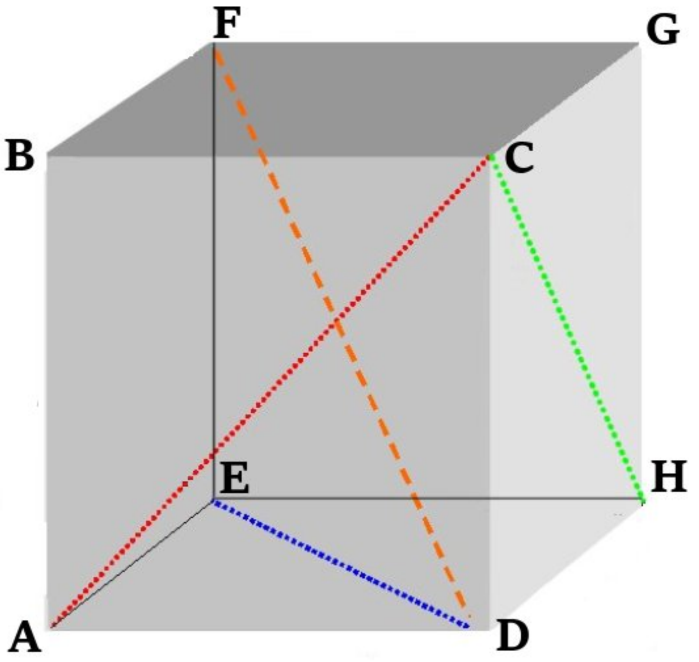
Prism + Rectangular Portion

Volume: **8,661,909.504 cu"** (Rectangular Portion)
+ 1,391,184.96 cu" (Prism)
10,053,094.464 cu" Chamber
5,817.763 cu' Chamber



Key to Niche Dimensions Charts





In the charts which follow, ***Queen’s Chamber Niche Dimensions***, each section of the five negative spaces in the Niche uses the same letter designations for the lengths and angles of its rectangular conformity.

Queen's Chamber Niche Dimensions

Niche #1

1

H: 67.16368286"
W: 61.8"
D: 41.50715601"

Top & Bottom Planes

∠DEH 33.88686352°
∠DEA 56.11313648°
DE: 74.44577446"

□ Area 2,565.142241 sq."
□ Top + Bottom Planes 5,130.284482 sq."

Front & Back Planes

∠BAC 42.61840411°
∠CAD 47.38159589°
AC 91.26993095"

□ Area 4,150.715601 sq."
□ Front + Back Planes 8,301.431202 sq."

Side Planes

∠DCH 31.71606523°
∠GCH 58.28393477°
CH 78.9544444"

□ Side Plane Area 2,787.773463 sq."
□ Both Side Planes 5,575.546925 sq."

Major Diagonal

∠FDE 42.05645793°
∠EFD 47.94354327°
DF 100.2648707"
DF 8.355405891'

Time DF as Pendulum: .203281328 sec.

Surface Area: 19,007.26261sq."
131.9948792 sq.′

Volume: 172,284.4 cu. in.
99.70162037 cu. ft.

Ledge W: 4.718770226"
Ledge Area: 195.862732 sq."
Area Both: 391.7254639 sq."

Niche #2

2

H: 31.70756888"
W: 52.36245955"
D: 41.50715601"

Top & Bottom Planes

∠DEH 38.40348232°
∠DEA 51.59651768 °
DE: 66.8181949"

□ Area 2,173.416777 sq."
□ Top + Bottom Planes 4,346.833555 sq."

Front & Back Planes

∠BAC 31.19658554°
∠CAD 58.80341446°
AC 61.21435314"

□ Area 1,660.28624 sq."
□ Front + Back Planes 3,320.572481 sq."

Side Planes

∠DCH 37.37642867°
∠GCH 52.62357133°
CH 52.23230667"

□ Side Plane Area 1,316.090967 sq."
□ Both Side Planes 2,632.181933 sq."

Major Diagonal

∠FDE 25.38597331°
∠EFD 64.61402669°
DF 73.95972573"
DF 6.1633104775′

Time DF as Pendulum: 2.7511757 sec.

Surface: 10,299.58797 sq."
71.52491645 sq.′

Volume: 68,913.76 cu. in.
39.88064815 cu. ft.

Ledge W: 5.427651769"
Ledge Area: 225.2863887 sq."
Area Both: 450.5727775 sq."

Queen's Chamber Niche Dimensions

Niche #3

3

H: 28.284271"
W: 41.50715601"
D: 41.50715601"

Top & Bottom Planes

∠DEH 45°
∠DEA 45°
DE 58.69998296"

□ Area 1,722.844000 sq."
□ Top + Bottom Planes 3,445.688 sq."

Front & Back Planes

∠BAC 34.27173831°
∠CAD 55.72826168°
AC 50.22792052"
□ Area 1,173.999669 sq."
□ Front + Back Planes 2,347.999318 sq"

Side Planes

∠DCH 34.27173831°
∠GCH 55.72826168°
CH 50.22792052"
□ Area 1,173.999669 sq."
□ Both Side Planes 2,347.999318 sq."

Major Diagonal

∠FDE 25.72684223°
∠EFD 64.27315777°
DF 65.15894413"
DF 5.42991201083 ft.

Time DF as Pendulum: 2.582305983 sec.

Surface Area: 8,141.686636 sq."
56.5394905 sq. ft.

Volume: 48,729.38701 cu. in.
28.19987674 cu. ft.

Ledge W: 5.539994675"
Ledge Area: 229.9079161 sq."
Area Both: 459.8158322 sq."

Niche #4

4

H: 28.93604528"
W: 30.42916666"
D: 41.50715601"

Top & Bottom Planes

∠DEH 36.245386°
∠DEA 53.754614°
DE 51.46628201"

□ Area 1,263.028160 sq."
□ Top + Bottom Planes 2,526.056336 sq."

Front & Back Planes

∠BAC 43.5592316°
∠CAD 46.4407684°
AC 51.466282007"
□ Area 880.4997445 sq."
□ Front + Back Planes 1,760.999489 sq."

Side Planes

∠DCH 34.88165979°
∠GCH 55.11834021°
CH 41.990819235°
□ Area 1,201.052946 sq."
□ Both Side Planes 2,402.105891sq."

Major Diagonal

∠FDE 29.34613387°
∠EFD 60.65386613°
DF 59.04297503"
DF 4.920247919'

Time DF as Pendulum: 2.45829727 sec.

Surface: 6,689.161716 sq."
46.45251666 sq. ft.

Volume: 36,547.04026 cu. in.
21.14990756 cu. ft.

Ledge W: 5.09316523"
Ledge Area: 211.4028038 sq."
Area Both: 422.8056076 sq."

Queen's Chamber Niche Dimensions

Niche #5

5

H: 27.756484"
W: 20.24283632"
D: 41.50715601"

Top & Bottom Planes

∠DEH 25.99826436°
∠DEA 64.00173564°
DE 46.18026004"

□ Area 840.2225602 sq."
□ Top + Bottom Planes 1,680.4451204 sq."

Front & Back Planes

∠BAC 36.10331494°
∠CAD 53.89668506°
AC 34.35396369"
□ Area: 561.8699591 sq."
□ Front + Back Planes 1,123.739936 sq."

Side Planes

∠DCH 33.771265552°
∠GCH 56.22873448°
CH 49.93261864"
□ Area 1,152.092712 sq."
□ Both Side Planes 2,304.185424 sq."

Major Diagonal

∠FDE 31.00782474°
∠EFD 58.99217526°
DF 53.87985543"
DF 4.4899879525'

Time DF as Pendulum: 2.348193564 sec

Surface: 5,108.370462 sq."
35.474794875 sq. ft.

Volume: 23,321.62442 cu. in.
13.49631042 cu. ft.

All 8 Ledges: 1,725.520464 sq."

Chamber + Niche

Whole Niche

Height: 183.848052"
5.320671'

Area Front (or Back) Plane: 8,427.371214 sq."
58.5234112 sq. ft.
Volume: 349,796.2116096 cu. in
202.4283632 cu. ft

Room

Width: 206"
Length: 226.6624676"
Height of Walls: 185.5097795"
Rec. Room Vol: 8,661,909.504 cu."
5,012.67911 cu. ft.

Prism

Height of Prism: 59.582809"
4.965234083 ft.
Floor to Apex of Prism: 245.0990604"
Volume Prism : 1,391,185.308 cu. in.
805.0840889 cu. ft.

Angle Apex: 119.8980855°

Room + Prism

Volume: 8,661,909.504 cu" (Rect. Portion)
+ 1,391,184.96 cu" (Prism Portion)
10,053,094.464 cu" Chamber
5,817.763 cu' Chamber

CHAMBER VOLUME: 5,817.7632 cu.'